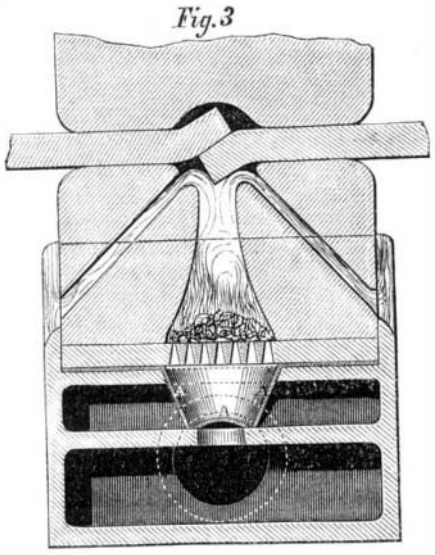
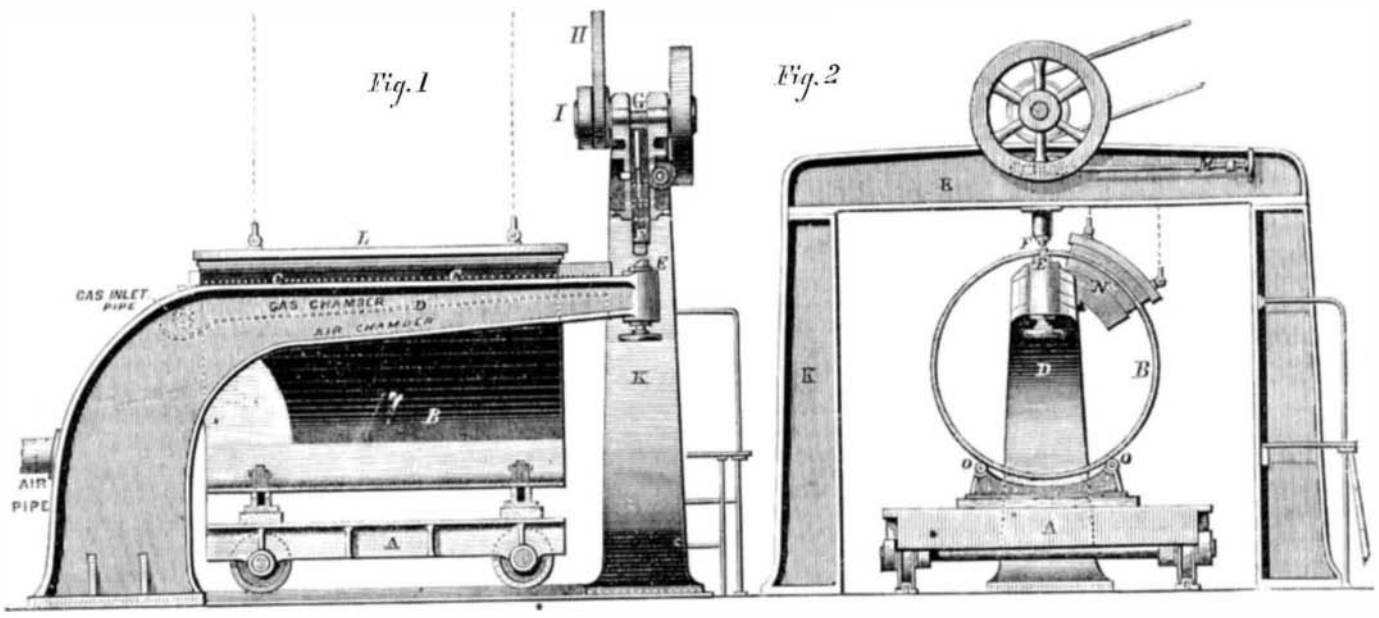
Improvements in Welding Plates.

We illustrate this week from the *Mechanics' Magazine* an invention just patented by Mr. W. S. Sutherland, Liverpool, England. It consists of a means of uniting the ends or edges of plates which are heated in a furnace of peculiar construction, while they are in contact to prevent the formation of scale on the meeting surfaces; also of a furnace for heating such plates, and the arrangements of the apparatus to bring the edges of the plates under the hammer head as speedily as possible while the plates are at a welding heat; the edges being first bent outwards, but in opposite directions, by suitable rolls or other appliance. The invention will be well understood by referring to the annexed engravings, where fig. 1 is an elevation of a furnace so arranged in connection with an overhanging girder as to facilitate a barrel of a boiler or tube to be brought into position for being welded at all the seams by the power hammer instead of being riveted, as clearly seen in the end view, fig. 2. The mechanism consists of a carriage, A, upon wheels for conveying the heated plates of the tube, B, to be welded under the hammer, so that they are united by a succession of rapid blows. The lower portion of the furnace consists of two chambers or passages, one for the fuel and the other for the air or other gas used to support combustion; these materials being led or forced into their respective chambers through the inlet pipe. The fuel and air or other gas pass through a diaphragm of wire gauze or perforated plate, the perforations being proportioned to properly mix the gases for combustion. The mixed fuel and air or other gases then pass through a perforated slab or tile of refractory materials into the combustion chamber and against the parts to be heated, and thence through the escape passages into the open air or into flues placed conveniently to receive them. The fuel is contained in and by the combustion chamber; suitable openings being left for extracting the residue. The air or gas for combustion passes from the chamber through the perforated



slab or tile of refractory materials amongst the fuel, and the heated products of combustion, after heating the parts to be welded, pass through the escape passages into the open air or into flues placed conveniently to receive them. The carriage, A, carries the tube, B, to be welded, which is adjusted so as to allow the parts to be welded to pass into and opposite to the furnace, C, carried by the arm, D; this arm, D, in some cases also carries the adjustable anvil, E; above this handle is the hammer, F, worked in this arrangement by means of an eccentric on the shaft, G, which eccentric is driven by means of the strap, H, acting upon the fast and loose pulleys, I I; the hammer, F, is carried by the standards and girders, K K. In some cases the furnace is carried by chains, so as to be raised and lowered easily. There is an arrangement for adjusting the hammer to suit various thicknesses of plates. The hammer is in two portions, the lower portion being screwed into the upper portion. This upper portion slides through a worm wheel driven by a worm turned by a hand wheel and spindle. N shows the improved furnace adapted for heating the edges of tubes to be welded together, end to end. The tube resting upon the rollers, o, o, has part of the seam to be welded heated by the improved furnace, and is then easily revolved by hand or otherwise and passed between the hammer and anvil and rapidly welded. Fig. 3 shows an enlarged section of a furnace with two edges of plates in position for being heated. In this form of furnace a fuel-pan, A, is employed which is to be supplied with air to support combustion and also with gases if necessary, the gases being driven into one of the chambers below.



IMPROVEMENTS IN WELDING METAL PLATES.

American Marbles.

The *Architectural Review* in discussing the subject of black marble and its treatment in architecture, says that at the present time the wealth in marble possessed by this country, instead of decreasing with the great demand made upon it for building and ornamental art purposes, is developing still more its intrinsic value in the recent discoveries of colored marbles of a superb quality which prolific Vermont has contributed to our national resources. In the rooms of the Royal Institute of British Architects, London, there are now to be seen specimens of American colored marbles which have called forth the admiration of all observers. Our present object, however, is to call attention not to the white or to the varicolored, but to the black marble which in its own way confers so much benefit on art by the very force of contrast it creates. It is generally of a fine texture (especially that which is very deep black), but it is rare to find it without calcareous spar in veins through it. The best quality occurs in beds of from three to eight inches thick; but some beds are thicker. It is tough, and contains a good deal of carbon, which imparts the color. It is greatly valued for inlaying, and is extensively used for vases, pedestals, chimney pieces, etc.

It is occasionally ornamented by etching and engraving, in which processes the polished surface is removed, and the brown color of the rough marble exposed. Powdered white lead is sometimes rubbed into the etched surface, to increase the effect. The French have a method of ornamenting marble in this way by etching with acids deeply into the marble various designs upon a properly prepared bituminous ground. When the corrosion has gone sufficiently deep, the cavities are filled up with hard colored wax, so prepared as to take a polish equal to that of the marble when cleared off. Drawings thus made on black marble, and filled in with scarlet wax, after the manner of Etruscan, have a fine effect, and are used for tables, paneling, etc. They have a method in Derby, England, where this art is carried on to a considerable extent, of exposing the brown color without destroying the polish, the effect of which is more durable than ordinary etching.

Rosewood marble, so called from its marking, resembling that of rosewood, is extremely hard and of close texture, being next in these respects to the black variety. The beds are of considerable thickness, but the most beautiful part of the marble is only about six inches thick. The *russet* or *bird-eye* marble takes its name from its color and appearance—the shades varying from light gray to brown. It contains numerous minute embedded or encrinital fossils, and is found in layers of from six to eighteen inches in thickness.

As yet, we believe there has been but one quarry of black marble worked in this country, namely, that of the Mosquito Valley, near Williamsport, Pa., which is a very compact, excellent material, but until very lately every effort to polish its surface proved a failure. We, however, have now on our table a highly creditable specimen of polished black marble from the quarry just named, and we entertain a strong hope that black marble in abundance will be found native to our soil, and worthy of a distinguished place in the art-materials of our country.

Changes in Fishes.

In the *American Naturalist*, Charles C. Abbott, M.D., gives some account of the changes in the fishes of New Jersey within a few years. A slight local disturbance sometimes quite alters the fauna. Thus in 1867 a small, never-failing brook, emptying into the Assumpink, was populated by chubs, dace, and minnows. In July a heavy, sudden fall of rain caused a rise of water, but did not alter the brook enough to attract the attention of those who lived near it. After the subsidence of the water not one of these fish could be found there, while their place was taken by roach, mullets, and red-fins, which are now abundant, while not a chub can be found.

Dr. Abbott mentions several fishes that were not inhabitants of the New Jersey streams twenty-five years ago, which are now quite abundant; and he is greatly at a loss to imagine how they can have reached these streams. He mentions the interesting case of the gizzard shad, which is sometimes carried by freshets into inland streams or ponds. A pond near Trenton was stocked with them in 1857, and is now full of specimens, weighing sometimes five pounds. They have become so different in color from the same fish as found in the Delaware and on the coast that Dr. Abbott at first thought them quite distinct; and he says they have changed considerably, but only in color, during the last ten years.

McNEIL'S IMPROVED TOBACCO PIPE.

Tobacco has come to be such a staple article of luxury that any improvement connected with its use, and having sufficient merit to bring it into popular favor, is sure of an extensive sale.

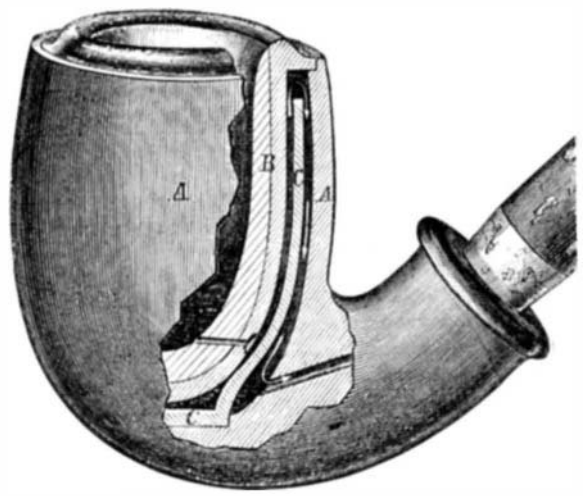
In smoking tobacco in pipes the following things take place. A portion is entirely burned, another portion is destructively distilled, and a portion of the active principle of the plant, nicotine, is distilled over with the water of which all tobacco contains more or less. A part of this moisture with its nicotine condenses in the pipe, and mingles with the tarry matter produced by destructive distillation, and the peculiar excellence of the meerschaum pipe is that it, from its very porous nature, absorbs or soaks up the oily noxious matter, and thus prevents its passage through with the smoke.

But meerschaum pipes are expensive and easily broken, and they have a trick of cracking upon so slight a provocation, that no man who buys a new one to-day can positively rely upon its being a whole one to-morrow.

In the pipe we here with present to the attention of our readers, a provision has been made for the collection of the foul matters, and for facility in their removal in an ingenious and novel manner. The pipe bowl—in the peculiar construction of which the invention consists—is composed of three parts or shells.

The outer shell, A, is formed after any appropriate design, and a shoulder formed on the inside of the upper edge supports an inner bowl, B, which has a flange or rim upon its upper edge, as shown.

The inner bowl is made of one kind of material, or it may be lined with any suitable material, as shown in the engraving.



It will be seen that when the outer and inner bowls are placed together, they do not touch except at the upper border, leaving an unfilled space in which a third bowl, C, is placed. Suitable openings being made near the bottom of the inner bowl, the smoke passes up and down between the surfaces of the three bowls, as shown by the arrows, depositing its nicotine and moisture within the bowl, C, from whence it is easily removed when necessary, as the parts may be separated and put together again with the utmost facility.

The inventor of this improvement is Wm. S. McNeil, office 104 Wall St., New York, to whom all communications should be addressed.

The First Japanese Railroad.

Letters from Japan state that the arrangements are completed for a line of railway—the first in the country—to connect Yeddo and Osaka, the new and old capitals of the Empire, a distance of 300 miles. There are also to be branches from Yeddo to Yokohama, and from Osaga to Tsuruga. The work will belong to the Japanese Government, but is to be carried out under the advice of English engineers appointed by Mr. H. N. Lay, who has selected Mr. Edward Morel as principal engineer. Mr. Morel has been summoned from Australia, where he was engaged in works for Mr. Edwin Clarke. An English loan of one million sterling is to be raised to meet the costs, and this will be secured not only by the line itself, but by a mortgage on the Custom duties collected at the ports. From three to five years is to be allowed for completion.

The Planet Mars.

The planet Mars is enveloped, exactly in the same manner as its next door neighbor, the earth, in a dense screen of mists and cloud; and it is only at the favorable moments when these clouds are rent asunder, that the actual surface of the planet can be seen. When the cloud curtains are most close-drawn the hue of the planet is greenish-white; when the curtains are flung open the planet wears a ruddy light. The planet's body is red, like the red sandstone of the earth. The drapery of clouds is of the same tinge as the clouds of the earth when seen hanging in masses under reflected illumination.

Under these circumstances, the only way in which anything like an idea can be formed of what the appearance of the planet would be if the drapery of cloud was entirely removed, is to fit together piecemeal the several passing glimpses that are caught of different parts of its surface at favorable times. The best views are so fleeting and capricious that the observer has to watch continually for hours to catch, it may perhaps be, but a momentary glimpse, which then has to be quickly fixed in the mind in order that it may be accurately transferred into the form of an endering record. And this task can only be worked at, it will be remembered, when the planet is in opposition; that is, when it is on the same side of the sun as the earth, and therefore in its nearest approach to the observer—a circumstance which recurs after intervals of 780 days. The observations of Beer and Madler were made with a fine telescope of Fraunhofer's construction, which enlarged the apparent dimensions of the planet from 23 seconds to 110 minutes of arc, and which made its disk seem nearly four times as broad as the moon. Instruments of this class, until very recently, have been very costly affairs. But through the great ingenuity and skill of Mr. With, instruments of a high order of merit and power can be now supplied at something like one fourth the cost of those of an earlier time. Mr. With's telescopes are reflecting instruments in which the mirror is made of silvered glass, glass being much more easily worked into perfect form than the old speculum metal, and silver afforded a far more brilliant surface than the mixture of copper and tin.

Photography is as yet unable to cope with work such as the delineation of the appearances on Mars, because the actinic power of the largely magnified image of the planet is very low, and because the complex movements of the planet and the earth both render prolonged exposures with any exactness of definition impracticable. Mr. Browning has nevertheless shown that there is something which photography can do in regard to this planet, although it cannot make the planet sit for its portrait. It can enable any pair of human eyes to contemplate the picture of the planet exactly as it would be seen if at some favorable instant it could be caught entirely stripped of its veil of cloud. It can bring all the thousand-and-one results of patient and prolonged study and watching together into one glance. Such are, in fact, the stereograms of Mars which Mr. Browning has prepared.

It now only remains to draw attention to the leading features which are developed in these interesting delineations of Mars. Certain spectroscopic observations made by Mr. Huggins leave no reasonable ground to doubt that the red color of Mars is due to the physical character of the actual substance of those portions of the planet's surface. The ruddy hue is at all times less strongly marked towards the border of the visible disk of the planet, where it is more masked in consequence of the reflected light having to pass through deeper tracks of the planet's atmosphere than in more central regions. It is also very much more intense at some returns of the planet into the favorable position of opposition than it is at others. Thus, for instance, the planet was much more distinctly red in the year 1868 than it was in 1864. This seems to indicate that clouds are more prevalent in the platetary atmosphere at some times than at others. The greenish or bluish-gray patches have just such a character of light as would be reflected from large oceans of water. The red and gray patches of Mars are, therefore, now accepted as indicating a very high degree of probability that these are actually continents and seas, which are contemplated, by chance glimpses, upon the planet's surface.

The actual amount of solar light and heat which Mars receives from the great central luminary is less than one-half the amount which is conferred upon the earth; in more exact numbers the proportion is $\frac{43}{100}$.

From some careful investigations made by the philosopher Zollner, it appears that Mars appropriates for his own intrinsic use something more than seven-tenths (or more exactly ·7328 parts) of the solar energy which it receives, and reflects into space nearly three-tenths (or more exactly ·2672 parts).

With lessened solar force less vapor is raised into the atmosphere, and less rain is precipitated upon the land. There are, therefore, less vigorous traces of the changes that are worked by the wearing away of high land under the action of running water. Something also of the difference of sculpturing and contour are most probably due to the fact that a globe, having only one-seventh part the volume of the earth, would pass from the primeval incandescent and plastic condition into the hardened and rigid form much more rapidly, and therefore would not have the wrinklings and foldings of its contracted crust arranged in exactly the same way as the wrinklings and foldings of the crust of the larger earth.—*Prof. Mann.—British Journal of Photography.*

PALE LACKER FOR TIN PLATE.—Best alcohol, 8 oz.; turmeric, 4 drs.; hay saffron, 2 scr.; dragons'-blood, 4 scr.; red sanders, 1 scr.; shellac, 1 oz.; gum sandarach, 2 drs.; gum mastic, 2 drs.; Canada balsam, 2 drs.; when dissolved, add spirits of turpentine, 80 drops.

OBITUARY--ZERAH COLBURN, ENGINEER, AND LEADING WRITER OF ENGINEERING PAPERS.

We have had specially prepared for this paper a portrait of the late Zerah Colburn, which we publish with the accompanying obituary notice from the pen of his former associate, Mr. A. L. Holley, as published in the New York *Times*, of May 2d.

The name of Zerah Colburn is known to the engineers of all countries where professional literature exists, and his writings are perhaps more various in scope and more vigorous in practical treatment than those of any other member of his profession. In his death engineering sustains an irreparable loss.

Mr. Colburn was born in Saratoga, N. Y., in 1832, and was named after his uncle, the celebrated mathematician. His father died soon after, and his mother, very poor and infirm, removed to New Hampshire, where, during his boyhood, young Colburn earned his living on a farm. His early means and opportunities for acquiring an education were limited to a few months' attendance at a district school, a short clerkship in a factory, and such books as he could find in a remote country village. But his industry and his wonderful memory more than made up to him then, and throughout his life, his want of early advantages. From an odd volume of the old *Penny Magazine* he gained a knowledge of the world and an inspiration to see and figure in it, which all educational appliances fail to give the average boy of the period. At the earliest possible moment, young Colburn left the wilds of New Hampshire and struck out for civilization, and he kept moving till he finally settled down in its midst—in London. His first sight of a city, and, what was a greater thing to him, a locomotive, was at Concord. The strong but hitherto undeveloped mechanical talent in him at that sight asserted its proper place, and the locomotive was ever after his chief study, and the subject of his best conclusions and ablest writings.

He soon after, as he found means for support, removed to Boston. His first literary attempt was in verse for the *Carpet Bag*. His professional career commenced on the Concord Railroad, under the late Charles Minot, then its manager, who was attracted by the brightness and practical ideas of this singular youth. In a few months Colburn had mastered the anatomy and physiology of the locomotive engine, tabulated the dimensions and proportions of those under his observation, and published a small, but excellent and still useful, treatise on the subject. He then got a subordinate position, and soon rose to the superintendence of the locomotive works of Mr. Souther, in Boston. Here he tabulated and committed to memory (an easy task for him) the dimensions of all parts of the then standard locomotive, and the cost of all the materials and labor employed in its construction. With the exception of a few months at the Tredegar Works, at Richmond, where, in connection with Mr. Souther, he started the manufacture of locomotives, Mr. Colburn then made New York his head-quarters until 1858. His more important professional work at this time was his superintendance, for a year or more, of the New Jersey locomotive Works at Paterson, during which engagement he made some improvements, still standard, in the machinery of freight engines.

Although eminently fitted for the management of practical construction, Mr. Colburn early found that the literature of engineering was his true calling. He therefore joined the *Railroad Journal* of this city, in which professional readers, soon recognizing the hand of a master, began to look for a new era in technical journalism. And they were not disappointed. In 1854, Mr. Colburn started, in New York, the *Railroad Advocate*, a weekly, devoted especially to the machinery of railroads, and addressed chiefly to the master mechanics, and the more intelligent operatives. The next year he enlarged the *Advocate*, which soon reached a large circulation and great popularity, not only among railway mechanics, but among the profession at large. It is worthy of mention, as illustrating Mr. Colburn's extraordinary power of memory, that he kept no books for many months, but simply remembered when every subscription and advertisement fell due, and made no mistakes.

In the summer of 1855 Mr. Colburn thought he saw, in his large and favorable acquaintance with railroad men, the way to a fortune in the business of railroad supplies. He therefore sold the *Advocate* to Mr. A. L. Holley, then draftsman of the New York Locomotive Works, bought land warrants with the money, journeyed to Iowa and located his lands, and then returned to New York—but with another scheme. The frontier life had temporarily charmed him, and he got together an engine and machinery to set up a steam saw mill in the far West. But before his plans were completed, literature and civilization had resumed the mastery, and he fell to writing for the *Advocate*, because he could not help writing, and to arranging his supply business. The first thing—and the last—that he undertook in this direction was Ames' tires, and with his knowledge, industry, shrewdness, and his advantages with the professional press, he kept the hammers at Falls Village busy day and night building up an immense business, which, unfortunately, the character of the tires did not maintain.

But Colburn was not made for a merchant. He pined for larger professional observation and knowledge, and for a wider field. As suddenly as he went into trade he left it, and sailed for Europe. During a three months' stay or rather rush among the machine and iron works of England and France, whereof the story is recorded in the *Advocate*, and is of permanent value, he had become again and finally wedded to literature. Returning to New York, he connected himself again with the *Advocate*, which was then enlarged and entitled the *American Engineer*.

In the autumn of 1857, Messrs. Colburn and Holley were commissioned by several leading railroad presidents to visit Europe to report on the railway system and machinery abroad, and in view of the financial troubles of 1857, they were advised to stop, at least temporarily, the publication of their paper.

Permanent-way and coal-burning locomotives were found to be the most important subjects of the period, and in 1858 their report on these subjects, largely illustrated by engravings, was published and generally circulated among American railway managers.

Mr. Colburn's thorough and, to American readers, entirely new and startling analysis of the cost and economy of British railways, was the foundation of many of the reforms that have since, although slowly, become standard here, especially in the matter of improved road-bed and superstructure. The success of this book was such that its authors determined to continue their researches, and in the fall of 1858, Mr. Colburn again visited London. Here he commenced writing for the *Engineer*, then the leading professional journal, and soon became its editor. Under his vigorous management it largely increased in circulation and influence.

Mr. Colburn at this time wrote a supplement on the American Practice for a new edition of Mr. D. K. Clark's work on the "Locomotive Engine." After several years' hard work in London, Mr. Colburn resolved to start another engineering paper in America. He came out in the *Great Eastern*, on her first passage in 1860, and soon selected Philadelphia, the principal seat of mechanical engineering in this country, as the birthplace of his own *Engineer*. It was an excellent paper, and the few numbers published will have permanent value, but the time was not ripe, in America, for a publication of this kind, and Colburn, although he had learned to labor, had never learned to wait. In a moment of despondency he dropped his new enterprise, sailed for England, and again became the editor of the London *Engineer*. At this time he familiarized himself with the French language and professional literature. He also wrote several pamphlets on boiler explosions, heat, etc., the originality of which attracted great attention, and he commenced his great work on the locomotive engine.

In 1866, Mr. Colburn started in London the publication of *Engineering*, which is in all countries accounted the ablest and best serial publication on that subject, and he dissolved his connection with it only a few weeks before his death.

During his residence in London, Mr. Colburn was employed as consulting engineer on many important constructions, and prepared many valuable papers in addition to his editorial labors. The more noted of these were his papers before the Institution of Civil Engineers (of which he was a member) on "Iron Bridges" and on "American Locomotives and Rolling Stock," both of which received medals.

Mr. Colburn wrote vigorously, originally, and with understanding on all the leading subjects embraced under the head of engineering. On the locomotive, the steam engine and boiler at large, steam navigation, bridges, railway works, and mechanical engineering in general, he was a first-rate authority.

The saddest part of Mr. Colburn's story remains to be told. Overwork was at least a powerful agency in his early fall, and this, together with his natural impulsiveness and his habitual irregularity in relaxation, as well as in work, drove him, within a few months, into partial insanity. He came to this country a fortnight since, avoided all his old friends, strayed away to a country town in Massachusetts, and there died by his own hand.

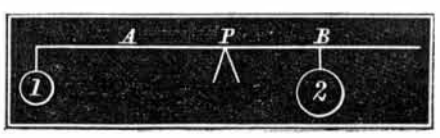
Zerah Colburn was a man whom the profession could ill afford to lose. His thoroughly practical education in the workshop, his extended observation of engineering works, his intimate acquaintance with professional literature, his remarkable quickness of comprehension, his more remarkable memory, and his mechanical talent and inborn engineering ideas, combined to give him a distinction that no engineer in the world will deny him—the best general writer in his profession.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

A Simple Question.

MESSRS. EDITORS:—It is reasonable, *a priori*, to assume that equal downward forces on the arms, A and B, are required to balance the rod on pivot, P; but the rod is balanced by a force of 1 on arm, A, against a force of 2 on arm, B. The downward pressure of 1 on arm A, is not increased by its



greater distance from the pivot, P, than force, 2, on arm, B, for the joint pressures on the pivot is only 1 + 2 = 3.

There is a law in nature, whereby the greater motion of a small force is made equal to the less motion of a greater force. But here there is no motion. How, then, does ar A, with half the force, equal arm, B?

Until a better explanation is given, we may suppose the greater force on arm, B, does, or rather would preponderate if the inseparable and simultaneous creation of motion infinitely small, did not arrest it, as with the parallel case of action and reaction.

T. W. B.

Pittsburgh, Pa.

Scraping Slide Valves.

MESSRS. EDITORS:—I notice in a recent number an article on "Scraped Surfaces." From thirteen years' experience, I find that for all kinds of slide valves and such like, a really good scraped-up face is a most decided benefit. But it is a lamentable fact that few workmen know how to scrape properly. I have always found that the scraper works best after